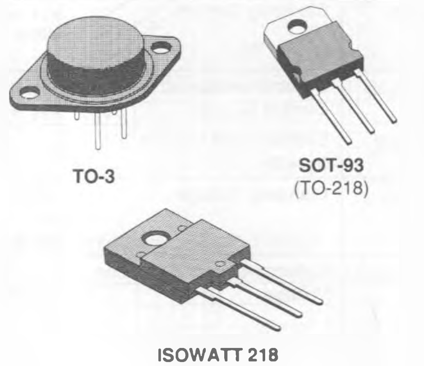
NPN POWER DARLINGTON

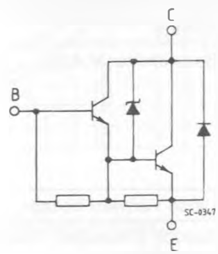
- HIGH RUGGEDNESS
- INTEGRATED HIGH VOLTAGE ZENER

AUTOMOTIVE MARKET

- APPLICATION IN HIGH PERFORMANCE ELECTRONIC CAR IGNITION



INTERNAL SCHEMATIC DIAGRAM



DESCRIPTION

The BU931Z, BU931ZP and BU931ZPFI are silicon multiepitaxial biplanar NPN transistors in monolithic darlington configuration mounted respectively in TO-3 metal case, SOT-93 plastic package and ISOWATT218 fully isolated package.

ABSOLUTE MAXIMUM RATINGS

Symbol	Parameter	Value			Unit
V_{CBO}	Collector-base Voltage ($I_E = 0$)	350			V
V_{CER}	Collector-emitter Voltage ($R_{BE} = 100\ \Omega$)	350			V
V_{CES}	Collector-emitter Voltage ($V_{BE} = 0$)	350			V
V_{CEO}	Collector-emitter Voltage ($I_B = 0$)	350			V
V_{EBO}	Emitter-base Voltage ($I_C = 0$)	5			V
I_C	Collector Current	20			A
I_B	Base Current	5			A
		TO-3	SOT-93	ISOWATT218	
P_{tot}	Total Dissipation at $T_c \leq 25$ °C	175	125	60	W
T_{stg}	Storage Temperature	– 40 to 200	– 40 to 150	– 40 to 150	°C
T_j	Max. Operating Junction Temperature	200	150	150	°C

THERMAL DATA

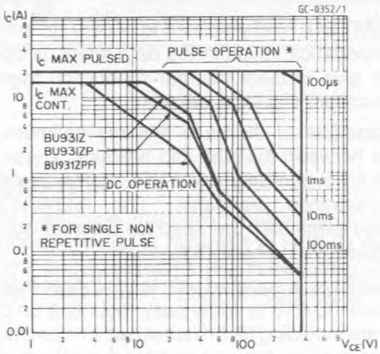
			TO-3	SOT-93	ISOWATT218	
$R_{th\ j\text{-}case}$	Thermal Resistance Junction-case	Max	1	1	2.08•	°C/W

ELECTRICAL CHARACTERISTICS (T_{case} = 25 °C unless otherwise specified)

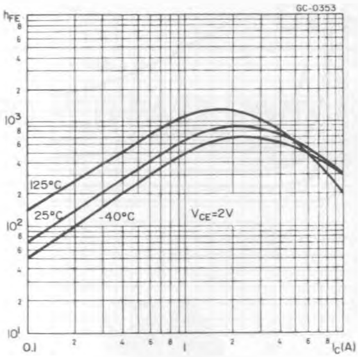
Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
I_{CL}	Clamping Current	V_{CE} = 350 either I_B = 0 or V_{BE} = 0			 250 250	 μA μA
$I_{CE(off)}$	Collector-emitter off State Current (I_B = 0)	V_{CC} = 16 V T_j = 125 °C V_{BE} = 300 mV			0.5	mA
I_{EBO}	Emitter Cutoff Current (I_C = 0)	V_{EB} = 5 V			50	mA
V_{CL}	Clamping Voltage	either I_B = 0 or V_{BE} = 0 and I_C = 100 mA same T_j = 125 °C	 350 350		 500 500	 V V
$V_{CE(sat)}$*	Collector-emitter Saturation Voltage	I_C = 7 A I_B = 70 mA I_C = 8 A I_B = 100 mA I_C = 10 A I_B = 150 mA T_j = 125 °C I_C = 7 A I_B = 70 mA I_C = 8 A I_B = 100 mA I_C = 10 A I_B = 150 mA		1.25 1.45 1.65 1.6 1.8 2	1.6 1.8 2	V V V V V V
$V_{BE(sat)}$*	Base-emitter Saturation Voltage	I_C = 8 A I_B = 100 mA I_C = 10 A I_B = 250 mA			2.2 2.5	V V
$V_{BE(on)}$*	Base-emitter Voltage	I_C = 5 A V_{CE} = 2 V T_j = – 40 °C T_j = 125 °C I_C = 10 A V_{CE} = 2 V T_j = – 40 °C T_j = 125 °C	 1.1 1.4	1.67 2	 2.1 2.4	V V V V V V
V_F*	Diode Forward Voltage	I_F = 10 A			2.5	V
$E_{s/b}$	Second Breakdown Energy Unclamped	L = 10 mH I_C = 10 A		500		mJ
$I_{s/b}$	Second Breakdown Collector Current	V_{CE} = 30 t = 500 ms for **BU931Z** t = 250 ms for **BU931ZP** t = 250 ms for **BU931ZPFI**	 6 4 1.7			 A A A
	USE TEST (see fig. 2)	V_{CC} = 24 V L = 7 mH	8			A

* Pulsed : pulse duration = 300 μs, duty cycle = 1.5 %.

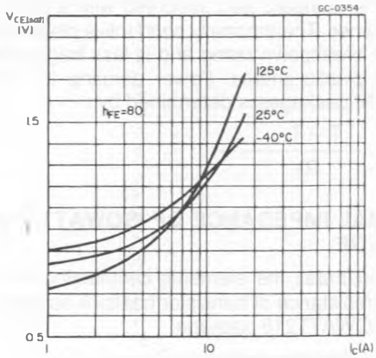
Safe Operating Areas.



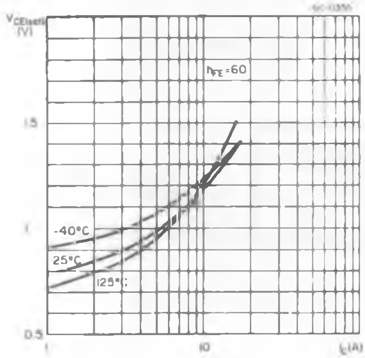
DC Current Gain.



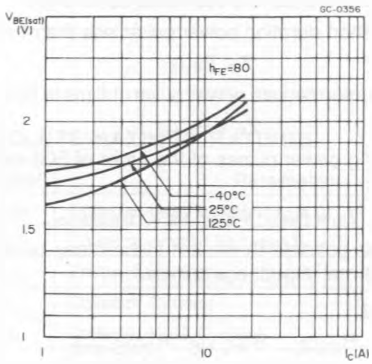
Collector-emitter Saturation Voltage.



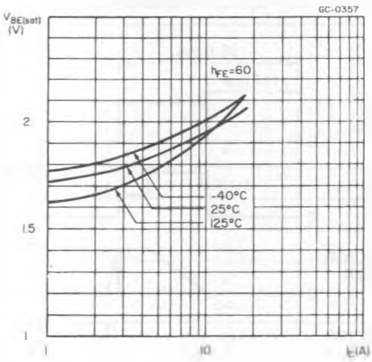
Collector-emitter Saturation Voltage.



Base-emitter Saturation Voltage.



Base-emitter Saturation Voltage.



Collector-emitter Saturation Voltage.

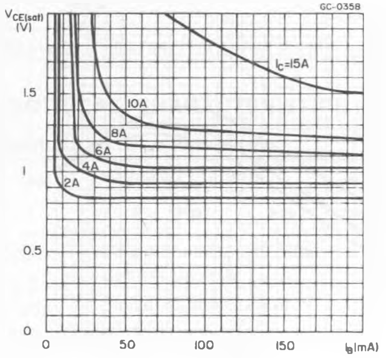


Figure 1 : Functional Test Circuit.

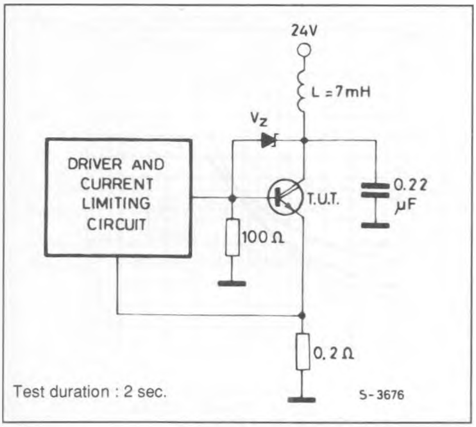
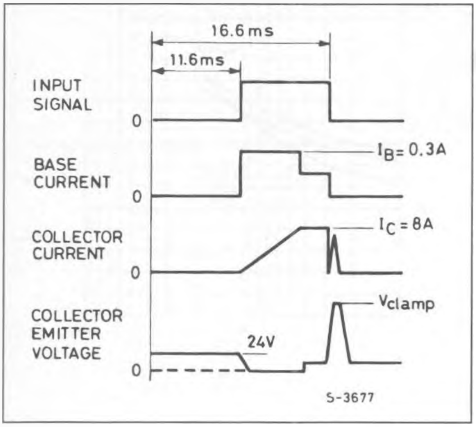


Figure 2 : Functional Test Waveforms.



ISOWATT 218 PACKAGE CHARACTERISTICS AND APPLICATION

ISOWATT218 is fully isolated to 4000 V dc. Its thermal impedance, given in the data sheet, is optimized to give efficient thermal conduction together with excellent electrical isolation.

The structure of the case ensures optimum distances between the pins and heatsink. These distances are in agreement with VDE and UL creepage and clearance standards. The ISOWATT218 package eliminates the need for external isolation so reducing fixing hardware.

The package is supplied with leads longer than the standard TO-218 to allow easy mounting on pcbs. Accurate moulding techniques used in manufacture assures consistent heat spreader-to-heatsink capacitance.

ISOWATT218 thermal performance is better than that of the standard part, mounted with a 0.1 mm mica washer. The thermally conductive plastic has a higher breakdown rating and is less fragile than mica or plastic sheets. Power derating for ISOWATT218 packages is determined by :

$$P_D = \frac{T_j - T_c}{R_{th}}$$

THERMAL IMPEDANCE OF ISOWATT 218 PACKAGE

Fig. 3 illustrates the elements contributing to the thermal resistance of transistor heatsink assembly, using ISOWATT218 package.

The total thermal resistance $R_{th(tot)}$ is the sum of each of these elements.

The transient thermal impedance, Z_{th} for different pulse durations can be estimated as follows :

1. for a short duration power pulse less than 1 ms ;

$$Z_{th}\ R_{thJ-C}$$

2. for an intermediate power pulse of 5 ms to 50 ms :

$$Z_{th} = R_{thJ-C}$$

3. for long power pulses of the order of 500 ms or greater :

$$Z_{th} = R_{thJ-C} + R_{thC-HS} + R_{thHS-amb}$$

It is often possible to discern these areas on transient thermal impedance curves.

Figure 3.